

Application No. 10/608,169

Response to Office Action following Decision on Appeal

### **REMARKS**

This responds to the Office Action mailed on March 28, 2008 following the Decision on Appeal by the Board of Patent Appeals and Interferences dated September 27, 2007. In the Office Action the examiner has objected to the Abstract of the disclosure and rejected all pending claims, 1 - 23.

In the above Appeal, Appeal Number 2007-2202 (Appeal), the Examiner was reversed as to independent claim 7 and statements were made as to how to overcome the rejection of independent claim 1.

In response to the Office Action the Abstract has been amended according to the suggestions of the Examiner, independent claims 1 and 7 have been amended, and the process to manufacture claims 14 - 23 are canceled.

#### **§112 Rejection of the Claims**

Claims 14-23 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In response to this Office Action claims 14 - 23 have been canceled.

#### **§102 Rejection of the Claims**

A "claim is anticipated only if each and every element as set forth in the claims is found, either expressly or inherently describe, in a single prior art reference."

*Verdegeall Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Claims 1-3, 6 were rejected under 35 U.S.C. § 102(b) for anticipation by Huber (U.S. 5,159,601). The Applicant has amended Claim 1 to overcome this rejection.

The present application discloses and claims a photonic frequency selection circuit. The circuit has a substrate 25, a photonic resonator 20, heating element 35,

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temperature sensor 30, processor 40, and current source 45. (¶ 10). The tuning of the temperature of the resonator 20 via the temperature sensor 30 and the heating element 35 changes the refractive index of the resonator 20, which thereby changes the frequency or color of light selected by the circuit. (See application ¶ 15). A precise listing of temperatures and frequencies are loaded into a logic device, and by selecting a temperature/frequency combination from the logic device, the frequency or color of light selected by the photonic circuit can be precisely selected. (See application ¶ 16). A particular frequency of light can be selected in a deliberate step manner to allow the photonic resonator to function as a **variable tunable photonic switch**.

Huber discloses a tunable laser. The laser comprises in part a pump 10, a dichroic mirror 14, an optical fiber 16, and a mirror provided by a grating 18. The grating 18 is connected to a substrate 22 which has a heating element 24 and a thermistor 26. The period of the grating 18 determines the wavelength of light reflected within the laser. By physically stretching or contracting the substrate 22 to which the grating is attached, the period of the grating 18 is changed, thereby changing the wavelength of the light reflected within the laser. (See col. 2, lines 43-64).

The Office Action states that Huber discloses a resonator in the form of a grating 18. The Applicant respectfully traverses this contention. The grating 18 in Huber is a mirror that depends on physical alteration of the period of the grating to determine the wavelength of light that is reflected by the laser. By contrast, the resonator recited in claim 1 of the present application has its refractive index altered by changes in temperature (or its refractive index is maintained constant by maintaining its temperature), thereby changing the frequency selected by the circuit. Since claim 1 recites a photonic resonator, and Huber does not disclose a resonator, but rather tunes a laser, claim 1 is not anticipated by Huber, and the Applicant earnestly solicits the allowance of claim 1. Additionally, Huber does not disclose any logic means as claimed in the invention.

The Applicant also solicits the allowance of claims 2-6, which depend on claim 1.

Claims 1, 3-4 and 6 were rejected under 35 U.S.C. § 102(e) for anticipation by Ueda (U.S. 6,498,878). The Applicant respectfully traverses this rejection.

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Ueda relates to a waveguide grating. The waveguide grating consists of an underlying clad 31, waveguides 14, and upper clad 33, deposited on a substrate 11. A heater 22 forms a zigzag pattern on upper clad 33. Col. 3, lines 39-49. The temperature of the waveguides is kept constant, thereby keeping the difference in lengths among the waveguides constant, which keeps the center wavelength of the output waveguides constant. Col. 4, lines 33-41.

The Office Action states that the waveguide grating 14 of Ueda is a resonator. The Applicant respectfully traverses this contention. The temperature control in Ueda is directed to maintaining the difference in length of the waveguides so that the output of the center waveguide remains constant. In the present application, the temperature of the resonator directly affects the refractive index of the resonator, thereby determining the frequency selected by the circuit. Consequently, the waveguides of Ueda are not resonators, and do not anticipate claim 1 of the application. The Applicant further respectfully submits that claims 2-6, which depend on claim 1, are also distinguished over Ueda.

Furthermore, claim 1 recites that the photonic switch retrieves a temperature/frequency pair from a logic device, and sets the resonator at that temperature so as to precisely select the associated frequency. Ueda does not disclose such a precise frequency selection scheme. Specifically, Ueda does not disclose a processor or memory that is used to precisely select a frequency like that which is disclosed in the present invention. Also, Ueda discloses a process of maintaining the temperature of a waveguide constant, so as the center wavelength of output wave guides are kept constant. Ueda is not concerned with selecting temperature frequency pairs in order to select a precise frequency in a photonic circuit. Consequently, claim 1 and its associated dependent claims, are patentable over Ueda.

The Office Action further states in relation to Ueda that "in order for the system [of Ueda] to associate a measured temperature with a desired temperature (which would cause the arrayed grating to perform the multiplexing/demultiplexing according to a designed protocol), it is inherent that some kind of logic is used (e.g., in the simplest form whether a measured temperature is equal or not to a set temperature)." For at least the same reasons outlined above in connection with the Huber reference, Ueda does not

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necessarily function or contain all the claim limitations of claim 1, and therefore cannot anticipate claim 1 or claims 3, 4, and 6 that are dependent on claim 1.

Claims 1, 3, 6-8 and 11 were rejected under 35 U.S.C. § 102(e) for anticipation by Eggleton (U.S. 6,438,277). The Applicant respectfully traverses this rejection.

Eggleton discloses a thermally tunable optical device 9 that has an optical waveguide 10, thermally sensitive optical element 11, electrical resistance heater 12, current source 13, and a control circuit 14. The control circuit 14 has a microprocessor controller 15 and a resistance detector 16. The resistor detector 16 is coupled to the heater 12, and the output of the detector 16 is supplied to the controller 15. (Col. 2, line 64 — Col. 3, line 11). The signal from the detector 16 to the controller 15 is used to stabilize the device. (Col. 3, lines 37-38). Eggleton is not a monolithic device. The invention of Eggleton is the use of temperature stabilization against ambient changes. Eggleton is not used for changing temperature so as to pick off selected frequencies. Therefore, Eggleton does not provide a stepped photonic switching of frequencies (colors) of light as the instant invention.

The present invention is not directed to stabilizing a device like Eggleton, but rather, is directed to precisely controlling a photonic switch by selecting temperature/frequency data from a logic device, and adjusting the temperature of the resonator to that temperature, thereby precisely controlling the frequency selected by the photonic circuit. Eggleton does not disclose such a precise temperature/frequency logic means to select a particular frequency. Moreover, the infinitely variable and precise control of the frequency selected by the present invention is not inherent in Eggleton. Indeed, Eggleton discloses only a conventional feedback loop to maintain the stability of the device (Col. 4, lines. 10-15), not extensive temperature/frequency logic to operate as an infinitely variable switch. Also, Eggleton discloses only a single control signal to the microprocessor 15 (to *stabilize* the circuit against *ambient* changes, Col. 2, line 35), not extensive temperature and frequency logic to infinitely and variably select a frequency as disclosed by the present invention. There is no switching disclosed or suggested in Eggleton.

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The Office Action further states in connection with Eggleton that "in order for the system [of Eggleton] to associate a measured temperature with a desired temperature (which would cause the grating to transmit or reflect the desired wavelength), it is inherent that some kind of logic is used (e.g., in the simplest form whether a measured temperature is equal or not to a set temperature)." For at least the same reasons outlined above in connection with the Huber reference, Eggleton does not necessarily function or contain all the claim limitations of claim 1 or claim 7, and therefore cannot anticipate claim 1 or claim 7. Since claims 3, 6, 8, 10 and 11 depend on claim 1 or claim 7, Eggleton does not anticipate those claims either.

**§103 Rejection of the Claims**

Claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Huber (U.S. 5,159,601) in view of Koizumi (U.S. 5,696,543).

Claims 9 – 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Eggleton et al. in view of Koizumi et al.

Claim 12 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Eggleton (U.S. 6,438,277) in view of Schwindt (U.S. 6,720,782). The Applicant respectfully traverses this rejection.

Claim 13 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Eggleton et al (U.S. 6,438,277) in view of Sorin et al. (U.S. 5,982,791).

To find the present invention *prime facie* obvious, at the very least, all of the elements of the rejected claims, 5, 9 - 10, 12 and 13, must be disclosed in the references (Huber with Koizumi, Eggleton with Koizumi, Eggleton with Schwindt or Eggleton with Sorin) upon which the rejection is based. First, there must be some suggestion or motivation, either in the reference themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings.

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Second, there must be a reasonable expectation of success. Finally the prior art reference (or reference when combined) **must teach or suggest all the claim limitations**. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) MPEP 2142 (emphasis provided).

Taking the obviousness rejections in turn, the Office Action states that Huber discloses all the limitations of claim 5 except for specifying that the metal wire of the temperature sensor is aluminum. Koizumi discloses the use of aluminum as a temperature sensor. Aluminum has good thermal properties and can be readily made a part of an integrated sensor process based on silicon microfabrication and hence is claimed for use by Applicants. Since the claim is based on an allowable independent claim, it too is allowable.

The Office Action states that Eggleton discloses all the limitations of claims 9 and 10 except for specifying that the metal wire of the temperature sensor is aluminum. Koizumi discloses the use of aluminum as a temperature sensor. Aluminum has good thermal properties and can be readily made a part of an integrated sensor process based on silicon microfabrication and hence is claimed for use by Applicants. Since the claim is base on an allowable independent claim,

The Office Action states that Eggleton discloses all the limitations of claim 12 except for specifying that during the measurement of the resistance of the wire, the value of voltage is taken by using a voltmeter connected to the wire via a Kelvin connection. Schwindt discloses a measurement probe used in conjunction with low-current and low-voltage measurements of wafers comprising a Kelvin probe. The probe station of Schwindt has nothing to do with photonics, Schwindt would not be used to teach or suggest the use of a Kelvin probe as part of the allowable claimed invention.

The Office Action states that Eggleton discloses all the limitations in claim 13, except for the measure of temperature being used as a key into a lookup table. Sorin discloses a use of a lookup table by a controller for correcting for strain in a Bragg

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grating. It does not teach or suggest this use in a photonic switch. Since the base claim 7 is allowable, so is dependent claim 13.

### **CONCLUSION**

Applicant by amendment to the claims has overcome the rejections of this Office Action. Neither Huber, Ueda or Eggleton taken singly or in combination with others discloses the claimed invention of a photonic circuit having temperature feedback and logic to provide a variable tunable switch for selecting a particular color of light in a stepwise manner.

The claims remaining are in a condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at 703-867-8334 if that would facilitate prosecution of this application.

No additional fees are required for this amendment. The Commissioner is authorized to charge payment of filing and processing fees or credit any overpayment to Deposit Account No. 19-0130 on behalf of Customer No. 22500.

Respectfully Submitted,

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For: Customer No. 22500

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